

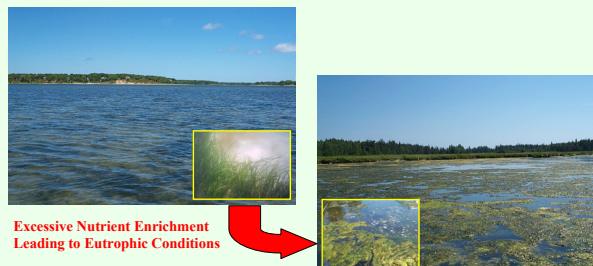
Development of Protocols for Tracking Nutrient Enrichment to Estuaries: National Park Service Vital Signs Monitoring Program - Virginia to Maine

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Overview:

In 1998 the National Parks Omnibus Management Act was passed by Congress mandating that all park managers know the condition and long-term trends of natural resources under their stewardship. In response to this act, NPS established a Vital Signs Monitoring Program to track indicators of park ecosystem condition within 32 biogeographic networks. Each network is charged with developing and implementing network-wide, long-term ecological monitoring programs that meet service-wide management goals.

Along the U.S. Atlantic coast from Maine to Virginia, the Northeast Coastal and Barrier Network and the Northeast Temperate Network contain nine parks with significant estuarine resources. Nutrient over-enrichment is identified by NPS as the most pressing management threat to estuarine resources in these networks, and the USGS is assisting with developing appropriate, feasible, and cost effective monitoring protocols to address this problem.

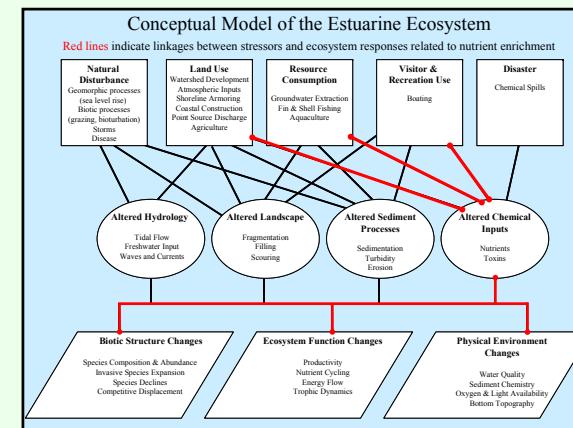


Monitoring Questions:

- Are nutrient loads to park estuaries increasing?
- Are estuarine resources changing in response to nutrient inputs?
- What are the sources of nutrient enrichment?

Project Goals:

- Creation of a monitoring protocol for estuarine nutrient enrichment within North Atlantic coastal National Parks.
- Final protocol should be consistent with other Federal monitoring activities including EPA National Coastal Assessment & NOAA National Estuarine Research Reserve System System-Wide Monitoring Program.



Approach:

1. Use Conceptual Model to identify potential monitoring variables
2. Inventory all existing and relevant stressor and ecosystem-response monitoring programs within North Atlantic coastal parks. Include NPS programs as well as other Federal, state, municipal, and NGO monitoring.
3. Screen all possible variables to arrive at a short list of Candidate Variables. Best Vital Signs will be:
 - Relevant to management concerns
 - Responsive to stressors and reliable
 - Cost effective and logistically feasible
 - Linkable to management actions

Candidate Monitoring Variables

Agents of Change

Land use/land cover
NPDES discharge permits
Atmospheric N deposition
Agricultural and domestic water use
Fertilizer Application Rates
Livestock populations
Housing density

Water quality

Dissolved oxygen
Chlorophyll a
Turbidity
Light attenuation
Temperature, salinity
Benthic invertebrates
Sediment organic carbon

SAV Distribution and Abundance

Bed size, structure, and location
Within-bed characteristics
SAV tissue nitrogen

Development Approach

Data harvesting from existing sources.
Protocols under separate development by S. Nixon at the University of RI.

2003-2004 Field Feasibility Test

Standard SOPs and costs available from EPA EMAP/National Coastal Assessment

State mapping programs/CCAP protocols

2003-2004 Field Feasibility Test

Feasibility Test: Water Quality Response Variables

Conducted at three Network Parks

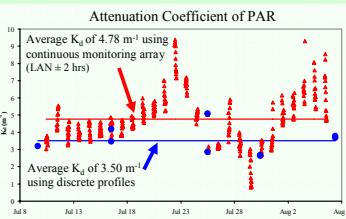


- Parks selected to represent a range of estuarine types: a) large urban embayments; b) oligohaline river and tidal creek systems; c) shallow lagoon
- Approach combines spatially and temporally intensive sampling
- Spatial survey conducted during 4-week late-summer index period
- Probability-based spatial design consistent with EPA National Coastal Assessment
- Continuous monitoring at single location during same 4-week index period
- Evaluation of prototype light monitoring system using LiCor PAR sensors wipers on board YSI Extended Deployment System water quality multi-probe



Data from the feasibility test demonstrate the value of continuous monitoring.

- At Colonial NHP, weekly measurements of PAR attenuation miss major turbidity events and yield a biased estimate of K_d .
- At Fire Island NS, a prototype PAR wiper system performs well & keeps sensors free of biofouling.



Feasibility Test: Seagrass Response Variables

Conducted at two locations within Cape Cod National Seashore

- Comparison of two sites (pristine vs. nutrient enriched)
- Uses established SeagrassNet global monitoring methods (www.SeagrassNet.org)
- 12 permanent stations along each of three transects (shallow, mid-depth & deep)
- Quarterly sampling during evaluation period
- Within-bed variables include shoot density, canopy height, epiphyte abundance, tissue N
- Evaluation of feasibility and data-utility when conducted without reliance on SCUBA
- May add anticipatory value to existing mapping programs

